

Attendance Problems: Write a conditional statement from each of the following.

1. The intersection of two lines is a point.
2. An odd number is one more than a multiple of 2.
3. Write the converse of the conditional “If Pedro lives in Chicago, then he lives in Illinois.”
Find its truth value.

I can write and analyze biconditional statements.

Vocabulary		
biconditional statement	definition	polygon
triangle	quadrilateral	

Common Core

- CC.9-12.G.CO.9 Prove theorems about lines and angles.
 □CC.9-12.G.CO.10 Prove theorems about triangles.
 □CC.9-12.G.CO.11 Prove theorems about parallelograms.
 □CC.9-12.G.SRT.4 Prove theorems about triangles.

4. What is a biconditional statement?

$p \leftrightarrow q$ means $p \rightarrow q$ and $q \rightarrow p$

Video Example 1. Write the conditional statement and converse within the biconditional.

A. An angle is a right angle if and only if the angle measures 90° .

B. A solution is an acid \leftrightarrow it has a pH less than 7.

1 Identifying the Conditionals within a Biconditional Statement

Write the conditional statement and converse within each biconditional.

A Two angles are congruent if and only if their measures are equal.

Let p and q represent the following.

p : Two angles are congruent.

q : Two angle measures are equal.

The two parts of the biconditional $p \leftrightarrow q$ are $p \rightarrow q$ and $q \rightarrow p$.

Conditional: If two angles are congruent, then their measures are equal.

Converse: If two angle measures are equal, then the angles are congruent.

B A solution is a base \leftrightarrow it has a pH greater than 7.

Let x and y represent the following.

x : A solution is a base.

y : A solution has a pH greater than 7.

The two parts of the biconditional $x \leftrightarrow y$ are $x \rightarrow y$ and $y \rightarrow x$.

Conditional: If a solution is a base, then it has a pH greater than 7.

Converse: If a solution has a pH greater than 7, then it is a base.

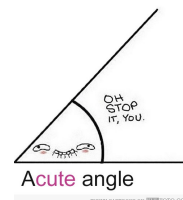
Example 1. Write the conditional statement and converse within the biconditional.

A. An angle is obtuse if and only if its measure is greater than 90° and less than 180° .

B. A solution is neutral \leftrightarrow its pH is 7.

Guided Practice: Write the conditional statement and converse within the biconditional.

5. An angle is acute iff its measure is greater than 0° and less than 90° .



6. Cho is a member if and only if he has paid the \$5 dues.

Video Example 2. For the conditional, write the converse and a biconditional statement.

A. If $10 = 7x - 4$, then $x = 2$.

B. If a triangle has three equal sides, then it is equilateral.



2**Writing a Biconditional Statement**

For each conditional, write the converse and a biconditional statement.

A If $2x + 5 = 11$, then $x = 3$.

Converse: If $x = 3$, then $2x + 5 = 11$.

Biconditional: $2x + 5 = 11$ if and only if $x = 3$.

B If a point is a midpoint, then it divides the segment into two congruent segments.

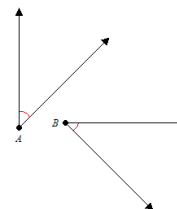
Converse: If a point divides a segment into two congruent segments, then the point is a midpoint.

Biconditional: A point is a midpoint if and only if it divides the segment into two congruent segments.

Example 2. For the conditional, write the converse and a biconditional statement.

A. If $5x - 8 = 37$, then $x = 9$.

B. If two angles have the same measure, then they are congruent.

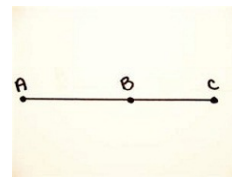


Guided Practice: For the conditional, write the converse and a biconditional statement.

7. If the date is July 4th, then it is Independence Day.



8. If points lie on the same line, then they are collinear.

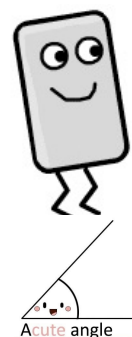


For a biconditional statement to be true, both the conditional statement and its converse must be true. If either the conditional or the converse is false, then the biconditional statement is false.

Video Example 3. Determine if the biconditional is true. If false, give a counterexample.

A. A rectangle has length 10 and width 3 if and only if it has an area of 30.

B. $\angle ABC$ is an acute angle $\Leftrightarrow m\angle ABC < 90^\circ$.



3 Analyzing the Truth Value of a Biconditional Statement

Determine if each biconditional is true. If false, give a counterexample.

A A square has a side length of 5 if and only if it has an area of 25.

Conditional: If a square has a side length of 5, then it has an area of 25. *The conditional is true.*

Converse: If a square has an area of 25, then it has a side length of 5. *The converse is true.*

Since the conditional and its converse are true, the biconditional is true.

B The number n is a positive integer $\leftrightarrow 2n$ is a natural number.

Conditional: If n is a positive integer, then $2n$ is a natural number. *The conditional is true.*

Converse: If $2n$ is a natural number, then n is a positive integer. *The converse is false.*

If $2n = 1$, then $n = \frac{1}{2}$, which is not an integer. Because the converse is false, the biconditional is false.

Example 3. Determine if the biconditional is true. If false, give a counterexample.

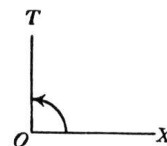
A. A rectangle has side lengths of 12 cm and 25 cm if and only if its area is 300 cm^2 .



B. A natural number n is odd $\leftrightarrow n^2$ is odd.

Guided Practice: Determine if the biconditional is true. If false, give a counterexample.

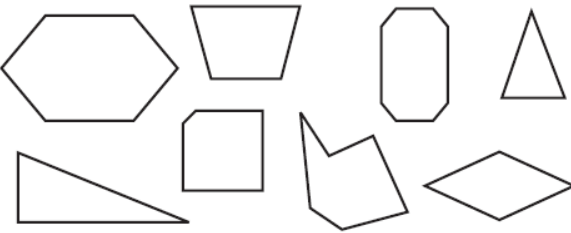
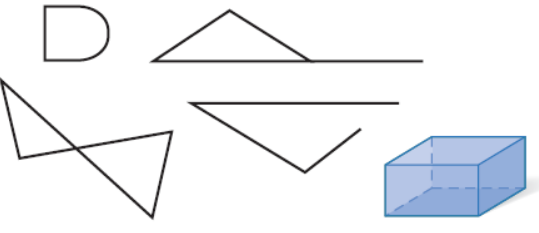
9. An angle is a right angle iff its measure is 90° .



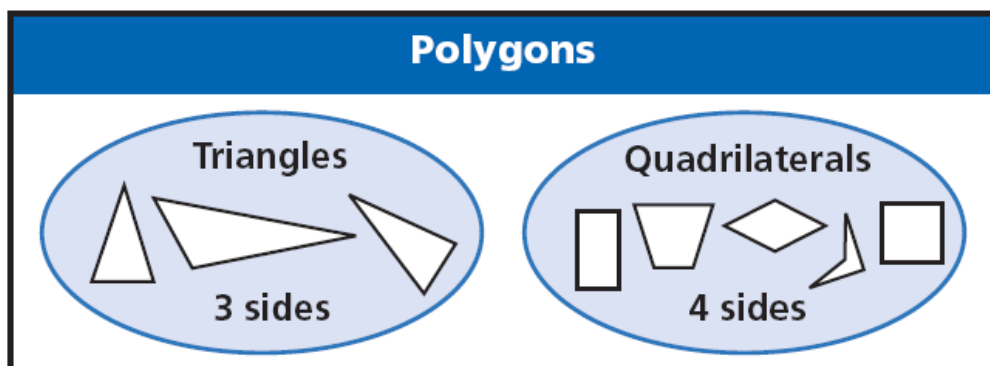
10. $y = 5 \leftrightarrow y^2 = 25$

11. What is true about all mathematical definitions?

In the glossary, a **polygon** is defined as a closed plane figure formed by three or more line segments.

Polygons	Not Polygons
	

A **triangle** is defined as a three-sided polygon, and a **quadrilateral** is a four-sided polygon.



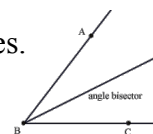
Helpful Hint

Think of definitions as being reversible.
Postulates, however are not necessarily true when reversed.

Video Example 4. Write each definition as a biconditional.

A. A quadrilateral is a four sided polygon.

B. An angle bisector is a ray or line that divided an angle into two congruent angles.



4 Writing Definitions as Biconditional Statements

Write each definition as a biconditional.

A A triangle is a three-sided polygon.

A figure is a triangle if and only if it is a three-sided polygon.

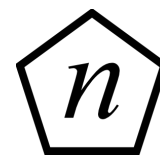
B A segment bisector is a ray, segment, or line that divides a segment into two congruent segments.

A ray, segment, or line is a segment bisector if and only if it divides a segment into two congruent segments.

Example 4. Write each definition as a biconditional.

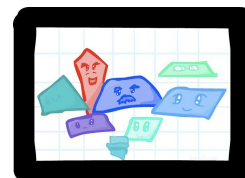
A. A pentagon is a five-sided polygon.

B. A right angle measures 90° .

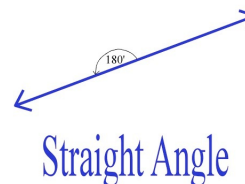


Guided Practice: Write each definition as a biconditional.

12. A quadrilateral is a four-sided polygon.



13. The measure of a straight angle is 180° .



2-4 Biconditional Statements and Definitions: (pp 99)

11-13, 15-19, 24, 28, 30, 35-37, 42.

Ready to Go On Section 2A pretest & posttest.

	Deductive Reasoning	Inductive Reasoning
Premises	Stated as <u>facts</u> or general principles ("It is warm in the summer in Spain.").	Based on <u>observations</u> of specific cases ("All crows Knut and his wife have seen are black.").
Conclusion	Conclusion is more <u>special</u> than the information the premises provide. It is reached directly by <u>applying logical rules</u> to the premises.	Conclusion is more <u>general</u> than the information the premises provide. It is reached by <u>generalizing</u> the premises' information.
Validity	If the premises are true, the conclusion <u>must be true</u> .	If the premises are true, the conclusion <u>is probably true</u> .
Usage	More difficult to use (mainly in logical problems). One needs <u>facts</u> which are definitely true.	Used often in everyday life (fast and easy). <u>Evidence</u> is used instead of proved facts.